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10,657/55.

PATENT SPECIFICATION

Complete Specification Lodged ..... 15th July, 1955.

Application Lodged (No. 10,657/55) ..... 15th July, 1955.

Bitumen synthetic resin vinyl polymers such as PVC, PVA

Applicant..... Expandite Limited.

Actual Inventors..... Peter Harrington Gibbs, William Duncan Parker and William Derrick Corlass Walker.

Convention Application.
(Great Britain, 20th July, 1954 and 18th March, 1955).
LAPSED BEFORE ACCEPTANCE.

Complete Specification Published ..... 19th January, 1956.

Classification 18.7;47.7.

No drawing.

COMPLETE SPECIFICATION.

"IMPROVEMENTS RELATING TO COMPOSITIONS CONTAINING TAR OR PITCH."

The following statement is a full description of this invention, including the best method of performing it known to us:-

Road carpets are, in general, made by hot-mixing a crushed mineral aggregate with a small amount of bituminous material as binder. They are usually laid and rolled whilst still hot. The quality of the carpet depends on the character, size, shape and grading of the aggregate and on the chemical nature and viscosity of the binder.

When such carpets are to be laid on airfields where jet turbine fuel and other oleaginous liquids may be spilt they should be resistant to attack by these liquids and should also resist the hot blast from the exhausts of jet aircraft. It has been found that normal carpets are inadequate to do this, and many attempts have been made in recent years to produce a satisfactory carpet.

The requirements for road surfaces have been extensively examined in recent years and it has been recognised that if the surface is to be impervious and of close texture the aggregate should be a mixture of coarse and fine material and that in addition there should be a filler

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of fine mineral dust. This recognition has led to the specification of Dense Tar Surfacing by the British Road Tar Association. This is a material which is applied hot and consists of a mixture of coarse and fine aggregate, filler, and high-viscosity tar the proportions of which are selected so that, after rolling, dense and impervious surfacings are obtained which are capable of carrying all types of traffic. The specification, entitled "Dense Tar Surfacing (D. T. S.)" sets out the required properties for the various ingredients of the material and requires that the tar should have an equiviscous temperature (E. V. T) of between 46 and 54°C.

We have found that not even "Dense Tar Surfacing" made as specified will fully meet the requirements for airfields set out above. In particular, "Dense Tar Surfacing" is eroded by jet turbine fuel and displaced under the action of the blast.

According to this invention we use a material which comprises an aggregate and a novel binder, the aggregate preferably being as defined in the "dense Tar Surfacing" specification; and the material may also contain a filler as there defined. The novel binder is a mixture of a coal tar product containing less than 5% by weight of constituents distilling below 300°C with a thermoplastic synthetic polymer of an organic compound containing the group $CH_2 = C <$ or an oil-resistant synthetic rubber and has an E. V. T. between 60 and 90°C. The binder preferably also contains asbestos or other fibres.

The coal tar product may be produced by removing the constituents distilling below 300°C from coal tar, and then may be regarded either as a viscous tar or as a soft coal tar pitch; or it may be a pitch fluxed with anthracene or other high-boiling tar oil. The binder will have an E. V. T. much higher than that of normal road tar, for which the upper viscosity limit is usually regarded as 50 to 55°C E. V. T. the tar used as a binder in "Dense Tar Surfacing" has an E. V. T. of 46 to 54°C, and in practice also contains as much as 9 or 10% of constituents distilling below 300°C in order that the tar may set by volatilisation. We have found that the presence of these volatile constituents is undesirable.

As the binder used in the present invention has a high E. V. T., the temperature during the mixing of the binder with the aggregate before the carpet is applied should be high, for example, from 140 to 160°C. This is appreciably higher than, for example, the temperature of between 95 and 105°C used in the production of "Dense Tar Surfacing". At these higher temperatures the volatile constituents of standard road tar are driven off as fumes which are most unpleasant, and even toxic, for the workmen operating the mixer, and in addition the binder will harden appreciably. It is therefore essential for these reasons that these constituents are removed. Further, the desired resistance of the final product to the sol-

vent action of jet turbine fuel and other oils is not obtained when these volatile constituents are present. We prefer that the amount of volatile constituents should be as low as possible, and in any event not more than 1% by weight.

While a carpet laid using a tar having an E. V. T. between 60 and 90°C but no polymer or synthetic rubber has improved properties in some respects, it is not satisfactory as the low temperature flexibility is poor. That this is so can be shown by putting specimen slabs of carpet, one made with tar with E. V. T. of 67°C and the other made with a binder of this invention having a similar E. V. T., in a refrigerator at a temperature of -10°C for 4 hours and then subjecting the slabs to a bending test. The slab made with high-viscosity tar fractures on bending where as the slab made according to the invention does not. As well as improving the low-temperature characteristics the presence of the polymer or synthetic rubber appears to reduce the alteration in properties of the binder by atmospheric oxidation and volatilisation during subsequent exposure.

Polymers which can be used include polyvinyl chloride, polyvinyl acetate, polystyrene, copolymers of vinyl chloride and vinylidene chloride, copolymers of vinyl chloride and vinyl acetate, and polymers of acrylic acid derivatives, such as polymethylmethacrylate. Synthetic rubbers which can be used include "Neoprene" and butadiene-acrylonitrile copolymers. The flexibility of the composition increases with increasing amounts of the polymer or synthetic rubber.

We prefer to add the polymer or synthetic rubber in amount between 1 and 4% by weight of the binder. The addition of this amount of polymer or synthetic rubber increases the E. V. T. of the coal tar product by as much as 20°C. The polymer or synthetic rubber is preferably mixed with the tar or pitch at temperatures between 100 and 150°C The whole binder can be made at once by such mixing, in the course of which the polymer or synthetic rubber disperses. The binder is then mixed with the aggregate and any other ingredients and applied tothe road or like surface as a carpet. Alternatively, the binder may be prepared by diluting a concentrate, consisting of the polymer or synthetic rubber dissolved in oil or coal tar product, and then mixing it with the aggregate.

The addition of very small amounts of a polymer of the kind defined above to coal tar for the purpose of improving its binding properties was proposed in British specification No. 478661. The addition of such a polymer to standard road tar does not, however, enable a carpet to be produced which will have the exceptional properties requir-

ed to withstand the combined effects of heat and blast from jet engine exhausts and the solvent action of jet turbine and other fuels, in addition to possessing good weathering qualities. When a specimen slab of carpet made with a standard road tar containing such a polymer was immersed in jet turbine fuel for 1 week, the slab was attacked with considerable loosening of its surface, whereas a similar slab made according to the invention was not attacked.

Adequate resistance to the solvent action of the fuel is given by binder and aggregate alone when densely compacted, but full resistance to hot blast is produced only when the asbestos or other fibre, e.g. rock wool or coconum fibre , is also present. A finely divided mineral filler such as limestone dust may also be present, but whereas this is essential with the tar used as a binder in "Dense Tar Surfacing " it is not so important with the more viscous binder of the present invention.

The preferred materials for surfacing airfields have the following range of composition, the percentages being by weight:

coarse aggregate	30 to 55%
fine aggregate	30 to 55%
filler	0 to 10%
asbestos fibres	2.5 to 3%
binder	6.5 to 7.5%

The surface on which the material is to be laid should be thoroughly cleaned of all foreign matter by brushing or scraping and should be properly shaped and the levels regulated where necessary with suitably graded tarmacadam so that the material is laid to a uniform thickness. When ordinary tarmacadam is used for the shaping, the area should be well-compacted before the material is applied over it. Before the material is spread a light tack coat of hot tar should be applied.

The thickness of the coating when it has been rolled to consolidate it should be about 1 inch. Rolling should take place as soon as possible after laying, and particular care taken to ensure adequate compaction of the material in the neighbourhood of joints.

Examples of two materials which when laid as carpets gave satisfactory resistance to both fuel and blast are as follows:

EXAMPLE 1.

Coarse aggregate

EXAMPLE 1. (Continued)

(limestone $\frac{3}{4}$" to $\frac{1}{4}$" size)	30% by weight
Fine aggregate (limestone $\frac{1}{8}$" to dust size)	53% " "
Filler (limestone dust, i.e. particles passing through a 200 mesh B.S.S. sieve)	7% " "
Short-fibre asbestos	2.5% " "
Binder	7.5% " "

The binder was made by dissolving a concentrated dispersion of polyvinyl chloride in anthracene oil in the proportion of 30% polymer to 70% oil, and thereafter dissolving 1 part of the concentrate in 9 parts of soft coal tar pitch which had an E.V.T. of 65°C and of which less than 1% distilled below 300°C. The resultant binder had an E.V.T. of 68°C

The weighed quantities of stone at a temperature of 150 to 160°C were put into a mixer, followed by the binder, which was at a temperature of 135°C. When the stone was nearly all coated with binder the limestone dust was added. The asbestos followed immediately afterwards. Mixing was then continued until all the aggregate was coated. The mixing temperature remained at 150 to 160°C throughout the operation. During laying and rolling the temperature of the carpet was 100 to 110°C.

EXAMPLE 2.

Coarse aggregate	38% by weight
Fine aggregate	43% " "
Filler	9.5% " "
Short-fibre asbestos	2.5% " "
Binder	7% " "

The binder was made by dispersing 3 parts of polyvinyl chloride in 97 parts of coal tar which had an E.V.T of 50°C and of which less than 1% distilled below 300°C. The E.V.T of the resultant

binder was 69°C. The aggregates and filler were the same as in Example 1, and the carpet was made in the same way as in that Example.

The material according to the invention may be used for road surfacing or flooring, as well as for airfield carpets.

The claims defining the invention are as follows:-

1. A material, comprising an aggregate and a binder, suitable for surfacing airfields, characterised in that the binder is a mixture of a coal tar product containing less than 5% by weight of constituents distilling below 300°C with a thermoplastic synthetic polymer of an organic compound containing the group $CH_2 = C<$ or an oil-resistant synthetic rubber and has an E.V.T. between 60 and 90°C. (20th July, 1954).

2. A material according to claim 1 which also contains asbestos or other fibres. (20th July, 1954).

3. A material according to claim 1 or claim 2 which also contains a filler. (18th March, 1954).

4. A material according to any of the preceding claims in which the coal tar product contains less than 1% by weight of constituents distilling below 300°C. (20th July, 1954).

5. A material according to any of the preceding claims in which the binder contains between 1 and 4% by weight of the polymer or synthetic rubber. (20th July, 1954).

6. A material having the following composition:

coarse aggregate	30 to 55% by weight
fine aggregate	30 to 55% " "
filler	0 to 10% " "
asbestos fibres	2.5 to 3% " "
binder	6.5 to 7.5% " "

the binder being a mixture of a coal tar product containing less than 5% by weight of constituents distilling below 300°C with a thermoplastic synthetic

polymer of an organic compound containing the group $CH_2 = C<$ or an oil-resistant synthetic rubber. (15th July, 1955).

7. A material according to claim 1 substantially as described with reference to either of the Examples. (18th March, 1955).

8. A method of preparing a material according to claim 1 which comprises diluting a concentrate consisting of the polymer or synthetic rubber dissolved in oil or the coal tar product, with the coal tar product and then compounding the diluted concentrate with the aggregate (18th March, 1955).

9. A material made by a method according to claim 8. (18th March, 1955).

10. An airfield carpet made from a material according to any of claims 1 to 7 or claim 9. (20th July, 1954).

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References:

Serial No.	Application No.	Classification
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